

INFRASTRUCTURE AND INTEROPERABILITY SUPPORT FOR PUBLIC HEALTH LABORATORIES

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II Narrative

A. Background, Need, and Understanding

The MDPH Office of Integrated Surveillance and Informatics Services (ISIS) within the Bureau of Infectious Diseases Prevention Response and Services (BID) oversees surveillance and informatics activities to meet the data needs of the Divisions of Epidemiology and Immunization, STD Prevention and AIDS Surveillance, TB Prevention and Control, the Refugee and Immigrant Health Program (RIHP) and local health. ISIS enhances and optimizes the collection and distribution of infectious disease surveillance data, and promotes standards-based electronic reporting of notifiable disease data by hospital laboratories, electronic health records, and other public health partners.

The MDPH Bureau of Laboratory Sciences (BLS) Informatics Office supports critical public health laboratory functions, including evaluation and implementation of new diagnostic testing methods, development of IT capacity to respond to new public health events and emergencies, and enhancement of communications and data transfer between the state laboratory and its partners. Each BLS laboratory program works closely with its corresponding BID disease prevention program on joint surveillance projects, investigations of outbreaks and clinical cases, and other collaborative programmatic initiatives.

The Electronic Laboratory Communications and Reporting (ELR) System

As a result of the strong collaboration between the BID and BLS, the Bureaus jointly developed the Electronic Laboratory Communication and Reporting (ELR) system to support the electronic exchange of information between public health agencies and its clinical partners, including hospitals, laboratories, providers and electronic health records. The system was deployed in October 2004. It is a secure web-based system that is utilized by both BLS and BID.

BLS ELR

The BLS component of ELR provides laboratories and other health care partners with ability to receive test reports electronically. The system also serves as a single point of entry for Massachusetts hospitals, clinics and other health care providers to electronically:

- Order tests and receive results electronically in HL7 format
- Search, view and print patient test reports, individually or by batch
- View the status of test orders.

BID ELR

Notifiable Disease Reporting

The BID component of ELR allows hospitals and clinical laboratories to send data electronically on all reportable conditions to the MDPH BID. This includes laboratory results and clinical data held in electronic health records (EHR). These data are transmitted via HL7 to the BID's web based disease surveillance and case management system (MAVEN) and are then triaged for notifications and disease investigations by state and local health.

Laboratories utilize a web based user interface to create a mapping between MDPH selected LOINC and SNOMED codes and local laboratory equivalents. These mappings translate native

codes into their LOINC and SNOMED equivalents before data are transmitted to MAVEN. Institutions may securely transmit messages using the HL7 2.3.1 ORU RO1 or a MDPH developed message format that is transformed into HL7 2.3.1. Once these data have been transmitted to MAVEN, the LOINC and SNOMED codes are then automatically assigned to an appropriate disease event and surveillance case status.

Electronic Health Record (EHR) Data

As a partner in one of the CDC-awarded Center for Excellence in Informatics, MDPH is actively engaged in leveraging existing technical solutions, principally MDPH's ELR infrastructure, to electronically receive pertinent health information to support case investigations. As described MMWR (MMWR: 2008;57:373-6), the *Enhanced Support for Public Health Practice (ESP)* initiative, has successfully developed algorithms to automatically send key information to MDPH BID for the following notifiable diseases: syphilis, gonorrhea, chlamydia, pelvic inflammatory disease, tuberculosis, hepatitis A, acute hepatitis B, and acute hepatitis C. Data are sent to MAVEN utilizing HL7 and PHIN-MS via the ELR infrastructure.

Syndromic Surveillance

MDPH participates in a syndromic surveillance program in collaboration with investigators at the Children's Hospital, Boston. It utilizes chief complaint data from a statewide pediatric, emergency department-based system, the Automated Epidemiologic Geotemporal Integrated Surveillance System (AEGIS). AEGIS is a prototype of a real time outbreak detection system and fully automates data collection, integration, processing, visualization, interpreting and alerting. Data are written to a database, classified into syndromes, and assigned geo-coordinates according to patient home address and site of care. Observed daily, syndrome frequencies are compared with predicted levels. The system performs cluster analysis techniques. The AEGIS system utilizes the ELR infrastructure; emergency room data are extracted from hospital electronic health records and sent via the Simplified Message Format (SMF) to the ELR system, where the data are processed and forwarded to the AEGIS system for analysis.

The Massachusetts Virtual Epidemiologic Network (MAVEN)

The MDPH BID is deploying a PHIN-compliant, web-based disease surveillance and case management system, MAVEN, that enables state and local health departments to share public health, laboratory, and clinical data efficiently and securely over the Internet. MDPH utilizes the PHIN Preparedness Early Event Detection Functional Requirements and Process Flows. MAVEN allows the direct reporting of notifiable diseases by clinicians and local health, appropriate data-sharing between state and local health, and improved data management and analysis. It captures all relevant information on notifiable conditions and is easily modified to capture additional information as circumstances change, such as in a pandemic event or an outbreak of foodborne illness. The ELR system is the conduit for all electronic data sent to MAVEN.

At its core, MAVEN is a person-based system that allows for multiple disease events to be linked to an individual. This allows for sharing of complete demographic information across the person's disease events, as appropriate. It also allows for a more complete and accurate view of morbidity and reduces the burden of data entry. Further, MAVEN has a deidentified functionality that allows MDPH to capture critical non-person based surveillance data, which

includes rapid influenza results, food borne illness complaints, rabies exposures, and aggregate influenza reports from sentinel surveillance sites. BID has configured an outbreak management module to capture the clusters data identified through traditional means, electronic laboratory reporting, and potentially syndromic surveillance efforts. The module interfaces with the event level data in MAVEN so that persons and environmental data may be linked.

Once fully deployed, MAVEN will replace paper-based methods of data exchange. MAVEN has built in algorithms to identify urgent reports requiring an immediate response and excess reports of illness that might signal an aberration from normal disease patterns. It has automatic (24/7/365) notification of state and local officials of any event requiring their attention.

The State Laboratory Information System (SLIS)

The Bureau of Laboratory Sciences (BLS) has implemented a flexible and practical LIMS infrastructure that allows BLS to send and receive data between public health systems, hospitals, public health agencies and private reference laboratories. The LIMS infrastructure requirements were based on the Requirements for Public Health Laboratory Information Management Systems developed collaboratively in 2003 by state public health laboratories, APHL and the Public Health Informatics Institute (PHII). BLS was one of the public health laboratories that participated in developing this guidance.

The SLIS infrastructure includes the BLS Electronic Laboratory Communications and Reporting (ELR) system and a flexible LIMS system. ELR allows BLS to electronically and securely exchange laboratory orders, test results and data with public health laboratories, hospitals, surveillance partners, BID and the CDC. The LIMS system includes three distinct LIMS that support specimen processing, testing, and resulting functions. Interoperability between the LIMS and ELR is achieved with the use of standard ORM messaging and Rhapsody Integration Engine. ORM messaging is a subset of HL7, developed by BLS to send and receive results in various data formats between the three LIMS systems and ELR.

Rather than implementing a single large LIMS, BLS implemented three small, flexible base LIMS systems. The implementation of small, flexible LIMS components support the need to accommodate rapid changes and specific requirements of a given lab or type of testing. These systems include (1) the BtB customized COTS system that supports all serological, immunological and molecular testing, (2) the in-house developed Integrated Microbiology Laboratory (IML) system that supports all BLS microbiology testing, and (3) the Perkin Elmer Labworks LIMS that supports all chemical testing. All three LIMS components are secure and internal to BLS and support testing and reporting processes, instrument interfacing, rapid order entry, result messaging and the following functions:

- Registration of patient order information using barcoding capabilities
- Testing-related documentation and quality control
- Result verification and release for reporting in ELR
- Internal management reports
- Generation of a standard Order Message (ORM) – a custom, flexible and extensible XML structure based on HL7, to exchange data (orders, tests and results) between various internal and external systems. Its primary purpose is to facilitate the sharing of structured data across different information systems, particularly via the Internet. IML LIMS

generates and stores the ORM messages in a WebLogic JMS queue. BtB LIMS and PerkinElmer LIMS generate and place their respective ORM message as xml files in a network folder. The ORM message can be easily adopted and utilized by other public health laboratories.

The Rhapsody Integration Engine enables data exchange between LIMS and ELR and generates multiple HL7 message formats for various external systems. Rhapsody is configured to monitor the IML LIMS queue and the network folder for new messages. Each message is replicated and routed to ELR as an ORM, to MPDH BID as HL7 2.3.1(PHIN), to PHINMS Sender as HL7 2.3.1(PHLIP), and to LRN-B. Rhapsody also handles required LOINC and SNOMED coding vocabularies required by each messaging recipient (LRNB, PHLIP and hospitals). Code mappings are performed by Rhapsody by mapping LIMS local codes to message specific vocabularies, which include LOINC and SNOMED coding. This allows data mapping and message formatting (HL7 and other) functions to be independent of LIMS applications. Rhapsody communicates with the ELR system via secure web services with authentication and authorization. The published web service uses SOAP protocol with MIME bindings for transmitting attachments. The message is transmitted by invoking a web service method, which is acknowledged with a success code or error code. The electronic providers and hospitals use the same interface to receive results. ELR receives an ORM type message and BID ELR receives HL7 2.3.1 EDI PHIN messages from BLS. The system supports:

- Consistent use of data and messaging standards, forming a solid foundation to ensure interoperability among the different system components.
- Data mapping and message formatting (HL7 and other) functions in components independent of LIMS applications.
- Management of vocabulary coding in a central application, while message creation and data mapping are handled by Rhapsody IDE.

The BLS ELR system controls the BLS master provider/submitter entries (BLS and BID Clients). New providers and updates are entered into ELR and these are transmitted to each appropriate LIMS. The message format used for this is General Provider Message (PRM), an XML message.

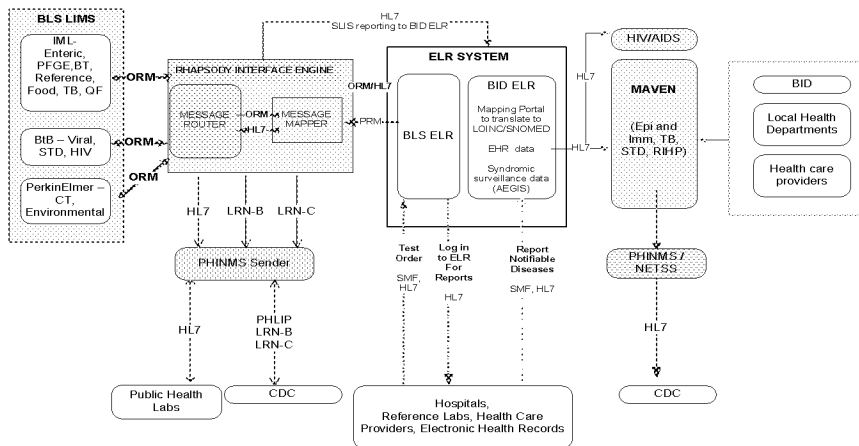
Electronic orders utilize HL7 batch protocol functionality for TB testing. Orders are uploaded in user-initiated batches to the BLS ELR system, and result reports are downloaded to the hospitals by user initiated batches. Each batch is uniquely identified with the sending facility and each order has a unique order number (PlacerOrderNumber) as well as a unique patient number.

Orders are sent to the BLS LIMS system from ELR with a unique UUID number. As orders are accepted into the BLS LIMS, a unique accession is assigned to them, a real-time message is sent to ELR acknowledging the acceptance, and the UUID stored in ELR is replaced with the accession number.

Result reports are sent to ELR in real-time and have the BLS accession number. These are batched into HL7 batches with the BLS accession and the hospital unique order number (PlacerOrderNumber) as well as a unique patient number. The hospital initiates the download of available result reports in HL7 batch format and accepts them into their system.

Figure 1

Massachusetts Public Health Information Data Flow



B. Current Activities

Bureau of Infectious Diseases (BID)

There are a total of 79 hospital laboratories in Massachusetts. In 2008, Massachusetts revised its regulations governing laboratory reporting to require the use of the ELR infrastructure for reporting notifiable conditions. This has led to an increase in the number of participating sites although laboratories frequently cite a lack of resources as a reason for non-compliance. As of April 2010, 32 hospitals and one commercial laboratory are certified to transmit laboratory data via ELR and have discontinued paper and fax reporting or legacy systems. The BLS has also been certified to report influenza, TB, Quantiferon, pertussis, and the enteric diseases.

The certification process takes several months and involves the following components: creation of the HL7 message from the hospital LIMS, mapping of local codes to standardized coding sets accepted by MDPH (LOINC and SNOMED), message validation, and reporting validation. Post certification of laboratories involves on-going quality assurance of submitted data.

As of April 2010, 26 hospitals are submitting their data to AEGIS. ISIS continues to engage sites to participate in AEGIS as part of its ELR recruitment efforts.

MDPH collaborates with some of the regional health information organizations, such as the Mass EHealth Collaborative and MaSHARE. EOHHS is developing an HL7 Gateway to accept and route HL7 messages to support ELR, the immunization registry (MIIS) and the exchange of other clinical data.

MAVEN supports the surveillance and case management needs for all notifiable conditions at the state and local level, except STDs and HIV/AIDS, and has approximately 750 users. ISIS plans to deploy the STD and RIHP modules in the Fall of 2010.

ISIS is also expanding its surveillance system in an attempt to improve timeliness and completeness of reporting and case follow-up of specific diseases utilizing clinician-based reporting and an automated character recognition software for case report processing. Clinicians fill out a single page case report form which are then processed using the automated character recognition software, and sent to MAVEN via an HL7 message, using the ELR infrastructure. ISIS is currently working with a large provider group that utilizes EHRs to pursue electronic submission of these data.

Massachusetts has 351 independent jurisdictions responsible for case investigation and follow-up of notifiable diseases. ISIS has focused on deploying MAVEN to local health departments in a phased approach, which involves training, implementation and support with each. As of April 2010, approximately 175 of the 351 local health departments are utilizing MAVEN. In addition, a pilot is underway with a provider site to assess provider capacity to utilize MAVEN directly.

The BID has been PHIN-certified to send tuberculosis data to CDC via PHIN-MS, replacing TIMS. Validation of varicella data sent via PHIN-MS is underway.

Bureau of Laboratory Sciences (BLS)

The enhanced BLS LIMS infrastructure supports almost all BLS testing operations. BLS recently completed the development of the STD, HIV and Hepatitis components and will deploy the components in May 2010. Funding will be utilized to build the remaining laboratory components, reference bacteriology, viral serology and childhood blood lead testing into LIMS infrastructure. Detailed system specifications are completed for each of these lab components to ensure the integration can be completed within the 12 month project period. Each the upgrades will include interfacing with the ELR System using ORM messaging to allow providers the ability to electronically view the status of test orders, and receive test results, and print reports and use Rhapsody IDE to send and receive information with ELR and PHINMS. Over 40 hospital providers use the BLS ELR system to check on testing status and print patient test reports.

BLS continues to expand its use of PHINMS 2.7.0 SP1 since May 2008. BLS now transfers data for labs Foodborne, Viral and Rabies LIMS systems in .csv format. Data format differences for file type are handled by each respective LIMS. Folder based pooling method is used to centralize data for PHINMS transfer. BLS data transfer occurs every week on Monday mornings.

The BLS was selected as a PHLIP state and was awarded funding to develop PHLIP messaging for Influenza testing as part of the Electronic Laboratory Data Exchange to Support Pandemic Influenza Surveillance and Laboratory Testing Surge Capacity funding. BLS completed the development of the PHLIP messaging, passed both the structural and vocabulary validation phases of the project, and is prepared to go live with their PHLIP message.

BLS is utilizing the Emergency Preparedness grant and APHL funding to develop the BioThreat LIMS component and LRNB messaging. The project will result in BLS implementing the necessary message structure for all LRN BioThreat agents and transmitting data to the LRN Program. The project will be completed this summer. LRNB messaging will utilize the existing BLS IT infrastructure, including Rhapsody IDE for HL7 transformation and routing to ELR and

PHINMS for message transport to the LRN CDC. BLS is an active participant on the LIMSi group and is one of 4 states chosen to develop the LRNB message standard. The flexibility of the ORM structure will give BLS the ability to produce multiple HL7 message types that include PHLIP, PHIN, LRNB and LRN-C.

MDPH has the ability to quickly enhance and expand participation in these projects. IT contract staff as well as an ELR program coordinator will be hired to implement continued certification of laboratories sending data via ELR, to develop quality assurance protocols and reports, integrate LIMS components, expand HL7 e-ordering and reporting, promote the use of EHR to support public health practice, and to continue PHIN-MS certification.

C. Operational Plan

Activity 1: Build upon an implemented laboratory information management system (LIMS) to meet Stage 1 Meaningful Use criteria for reporting to public health agencies by applying the hospital (laboratories) care goal to public health laboratories:

MDPH currently has the infrastructure to receive electronic submission of notifiable laboratory results and would like to expand the number of participating sites to cover all hospital laboratories in Massachusetts as well as the larger national commercial laboratories. BLS will integrate remaining laboratory components into the LIMS. The components include reference bacteriology, viral serology and childhood lead screening. All of these deployments will include sending reportable laboratory results using the existing IT infrastructure to BID for certification and to the CDC. BLS will also expand HL7 electronic ordering and reporting capacity to include all tests performed at BLS. The current system is in place only for TB testing.

Over the course of this cooperative agreement, staff will:

- continue to facilitate implementation of ELR by national and local laboratories.
- provide quality assurance of notifiable disease data sent by laboratories.
- promote the use of the existing ELR infrastructure to support data sent from EHRs.
- integrate the remaining laboratory components in LIMS infrastructure.
- facilitate implementation of ELR at new BLS laboratory information systems are deployed.
- expand the HL7 electronic order and result functionality to all clinical tests performed by BLS and work with two funded hospitals to implement HL7 electronic ordering and resulting.

Activity 2: Collaborate with hospital laboratories and/or inpatient EHR in their efforts to satisfy the hospital care goal for public health reporting.

The same infrastructure that is utilized to transmit laboratory results via ELR may be used to support EHR data exchange. MDPH has already developed the proof of concept to transmit these data and would like to develop additional algorithms to report notifiable diseases from EHRs as well as expand the number of participating sites.

Over the course of this cooperative agreement, staff will:

- Continue to facilitate the implementation of AEGIS (syndromic surveillance) at Massachusetts hospitals.
- Identify appropriate data elements to be transmitted to MDPH and develop new protocols for data exchange with EHRs.
- Identify regional health information exchanges (HIE), including the Massachusetts League of Community Health Centers HIE, willing to transmit EHR data to MDPH.

Activity 3: Actively participate with other award recipients and CDC to develop a business case and/or use case for public health laboratories to exchange data with EHRs and public health agencies.

Over the course of this cooperative agreement, staff will:

- Continue to participate in relevant national working groups to support data exchange.
- Participate with other award recipients and CDC to:
- Develop business and use cases to support data exchange.
- Collect information on other lab data exchange activities and create an inventory of currently available standards, guides, tools and collaboration opportunities.

Activity 4: Establish a plan for how these data will flow within your jurisdiction, including, but not limited to, the management of records de-duplication and the unique identification of clinical partners.

A diagram of the flow of public health data within MDPH is detailed in Figure 1 on page 6

The BID's ELR system accepts all appropriate notifiable disease reports, and deDeduplication of persons and disease events occurs once the data are transmitted to MAVEN. Highly sophisticated algorithms are currently operational that both identify individuals whose records should be merged (in order to maintain a person –based system) as well as ensure laboratory reports are either appended to disease events or create new events.

Electronic orders are sent to the BLS LIMS system from ELR with a unique UUID number. Orders are accepted into the BLS LIMS with and unique accession is assigned to them. A real-time message is then sent to ELR acknowledging the acceptance and the UUID stored in ELR is replaced with the accession number. Result reports are sent ELR in real-time and have the BLS accession number. These are batched into a HL7 batches with the BLS accession and the hospital unique order number (PlacerOrderNumber) as well as a unique patient number.

Over the course of this cooperative agreement, staff will:

- Continue to assess the sensitivity of deduplication algorithms.
- Expand HL7 electronic ordering and reporting and maintain unique sample and reporting identification of test information with clinical partners to prevent data duplication.

Activity 5: As an initial effort toward standard messaging of laboratory orders and results (per first Activity listed above), implement the Public Health Laboratory Interoperability Project (PHLIP) influenza messaging guide and implementation guide.

The BLS was selected as a PHLIP state and received funding to develop the PHLIP Influenza as part of the Electronic Laboratory Data Exchange to Support Pandemic Influenza Surveillance and Laboratory Testing Surge Capacity funding. BLS completed development of the PHLIP message and passed both the structural and vocabulary validation phases of the project and is prepared to go live with their PHLIP message. BLS will continue participate in PHLIP data harmonization activities for National Notifiable Diseases to ensure PHLIP message specifications and vocabularies are met and incorporated in BLS messaging.

Over the course of this cooperative agreement, staff will:

- BLS will continue participating and to development of PHLIP messaging for reportable diseases beyond Influenza.

- Implement influenza message structure according to the PHLIP Influenza Messaging and Encoding Guidelines, “APHL-CDC PHLIP Messaging Guide For Influenza_Test Result Reporting_By Public Health Laboratories_Oru^R01”.

Activity 6: Request and utilize the guidance and subject matter expertise provided by recipients of the Laboratory Technical Implementation Assistance for Public Health cooperative agreement program (LTIAPH) for configuration and enhancement of a LIMS and/or other critical IT infrastructure for implementation of messaging and data standards within the public health laboratory.

Over the course of this cooperative agreement, staff will:

- ~~e~~Collect information on services and solutions provided by LTIAPH grantee and LTISSA to ensure the MDPH critical IT infrastructure to supports interoperability of electronic laboratory data between clinical care (through EHRs) and public health agencies.
- ~~r~~Request initial evaluation and recommended approach from LTIAPH grantee.
- ~~C~~ontinue to participate in the CDC LIMS Integration WorkGroup.

Activity 7: With a priority focus on the Interim Final Rule standards and certification criteria, align technical activities with harmonized standards, processes, and requirements already established and advanced for electronic laboratory data exchange by ongoing efforts such as Nationwide Health Information Network (NHIN), the Public Health Information Network (PHIN), Electronic Laboratory Reporting (ELR), Healthcare Information Technology Standards Panel (HITSP) and PHLIP.

MDPH's existing infrastructure is fully compliant with all relevant national standards. MAVEN is PHIN compliant and is in the process of becoming PHIN-certified. MDPH's ELR infrastructure utilizes LOINC and SNOMED coding schemas and conforms to national ELR standards. MDPH has been certified to submit TB via PHIN-MS. BLS HL7 messaging complies with PHIN ELR messaging requirements. The LIMS implemented the Public Health LIMS requirements developed by APHL in 2003 and LIMS logical design requirements.

Over the course of this cooperative agreement, staff will:

- ~~e~~Continue to utilize the requirements set forth by the CDC to ensure all systems remain aligned with current national standards.
- ~~e~~Ensure that HITSP standards are employed as EHR messaging protocols are developed.
- ~~p~~Perform a gap analysis on IT infrastructure components to identify and purchase necessary infrastructure and hire necessary personnel
- ~~d~~Develop test and production plans for data exchange and share data exchange tools and standards with the CDC and other grant recipients.

Activity 8: Leverage technical solutions and architecture delivered through the Public Health Laboratory Interoperability Solutions and Solution Architecture contract, including proposed architecture components, such as public health laboratory interoperability hubs, services of a national electronic test order and laboratory result reporting system, and a national-level public health metadata repository.

Over the course of this cooperative agreement, BLS staff will:

- ~~BLS will r~~Request assistance of the PHLIP technical assistance teams through APHL to assist in implementing the PHLIP ELSM and connection to CDC through the Route not Read hubs.

- BLS will continue participation on the LIMS Integration WorkGroup - Pilot Project Core Group to ensure standards are maintained.

Activity 9: Participate actively in regular calls with CDC project staff to discuss project implementation and progress.

Over the course of this cooperative agreement, staff will:

- Participate in all calls with CDC staff to review project implementation and progress.

Activity 10: Participate actively in user groups to share successes and lessons learned with other awardees specific to the advancement of capability towards the exchange of public health laboratory data with EHRs.

Over the course of this cooperative agreement, staff will:

- Participate in user groups to share successes and lessons learned.

Activity 11: Develop a sustainability plan to ensure activities funded through this program are sustained after the award period has ended.

It is anticipated that significant cost savings will be achieved with having all hospitals report via ELR. Resources may be realigned to support on going quality assurance efforts and IT support.

Over the course of this cooperative agreement, staff will:

- Develop a plan to ensure appropriate activities funded through this program are sustained.

Activity 12: Develop and maintain detailed reporting and tracking processes to support this project as determined by established project management methodology (e.g., Project Charter, Project Kick-Off Meeting, Project Management Plan, Project Schedule).

Detailed project plans for ELR and SLIS are operational and will be updated as appropriate.

Over the course of this cooperative agreement, staff will:

- Develop a new project plan to detail the proposed implementation of the EHR project.
- Ensure project timelines and milestones are met. Identify specific risks and delays regarding project schedule and resources.

Activity 13: In collaboration with other awardees, assist in the development of a system of metrics to successfully measure project performance.

Over the course of this cooperative agreement, staff will:

- Collaborate with other awardees to develop appropriate metrics to assess project performance.

Activity 14: Track, measure, and report programmatic and fiscal activity and economic impact, including job creation, retention and sustainability.

Over the course of this cooperative agreement, staff will:

- Submit all requested information to CDC as requested.

D. Staffing and Responsibilities

The Director of ISIS, BID IT and BLS IT Directors will have overall responsibility for ensuring the success of these projects and for each of these activities.

| BLS IT Director: Dina Caloggero, MPA, BSMT I(ASCP): (1.0 ? FTE) Has over 20 years of experience in medical laboratory science, seven years in application development and support. Responsible for ensuring that the BLS project meets objectives and business requirements. Establish schedules, cost commitments and business priorities. Manage all aspects of application development, implementation, maintenance and support. Responsible for the BLS IT Staff. Develop and maintain project plan, IT budgets and spending plans for the BLS.

| LIMS Subject Matter Expert, HL7 Vocabulary Specialist, (0.5 FTE) (Consultant): Identify laboratory tests and data elements specific for accepting electronic orders from participating hospital. Identify laboratory results and data elements specific to reportable conditions. Coordinate participation on the PHLIP vocabulary and messaging workgroup. Lead efforts to utilize known laboratory data exchange tools and standards.

(1.5 FTE) Senior Programmers (Consultants): Responsible for design, coding, and testing of MPHL J2EE and Microsoft based applications. Assist in the design and implementation of the existing LIMS electronic ordering and resulting capabilities using WebLogic application server, XML, JSP, SWING and SOAP. Provide programming support for the database design and data reporting process, using Oracle, SQL, PL/SQL, and Visual Basic, including programming life cycle (design, code, test and document) in the existing MPHL LIMS environment.

| Director of ISIS: G. Haney, MPH (1.0 FTE) oversees programmatic activities related to the surveillance and informatics needs of the BID. Ms. Haney is an infectious disease epidemiologist and provides subject matter direction and management of MAVEN, ELR, EHR efforts, syndromic surveillance activities and other aspects of infectious disease reporting and surveillance. She was also an active member of one of the CDC Centers of Excellence in Public Health Informatics.

| Director of IT: D. Corban (1.0 FTE) oversees all IT activities and is responsible for creating the vision for IT systems at BID. Ms. Corban provides technical direction to and management of all IT projects serving the BID including, MAVEN, ELR and the Immunization Registry. In addition, she manages all IT services and consultants, operational processes, and develops and implements policy and procedures for accessing IT services and resources.

| A program coordinator (1.0 FTE): will support the continued rollout of hospitals reporting via ELR, facilitate protocol development and promote data exchange with EHRs, develop and implement quality control activities, and implement PH-MS messaging. Will report to the Director of ISIS and collaborate with the ISIS epidemiologists, IT programmers working in both the BID and BLS. Will work with public health partners to facilitate communications and promote electronic data exchange from a public health programmatic perspective. This position will be a new full time employee and will be hired as soon as feasible after the award.

| A senior programmer (1.0 FTE, contract) will support both the BID ELR infrastructure and EHR data exchange, and provide technical assistance for HL7 and PHIN-MS implementation. Will oversee all technical aspects of messaging between the electronic data reporting infrastructure and MAVEN. This position report to the BID Director of IT and will be a new full time contract, hired as soon as feasible after the award.

Increase the hours for ELR Project Management (1.0 FTE) (contract) for 24 months. This individual will provide project management for the ELR project with the remaining clinical and commercial laboratories and SLIS. This individual reports to the BID Director of IT. This individual will also provide project management for the implementation of electronic messaging from EMRs.

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E. Performance Measures and Evaluation Plan

Activity 1:

- Number of clinical laboratories recruited to participate in ELR
- Number of clinical laboratories completing training and code mapping
- Number of clinical laboratories certified notifiable disease data via ELR
- Number of BLS components integrated into LIMS and certified to submit data to BID
- Percent of BLS testing included in the HL7 electronic order and result functionality
- Number of hospitals submitting HL7 electronic orders and test results
- Development of quality assurance reports and protocols

Measures of Effectiveness:

- Within 18 months of the award date, all remaining hospitals have been recruited and attended an introductory orientation
- By the end of the cooperative agreement 90% of clinical hospitals will be certified to send data via ELR
- By the end of the cooperative agreement, notifiable disease data from the remaining SLIS LIMS will be transmitted to BID via ELR
- By the end of the cooperative agreement all sites sending data via ELR will receiving quality assurance reports
- By the end of the cooperative agreement all BLS testing will be included in the HL7 e-order and result function and two funded hospital will be sending and receiving results

Activity 2:

- Number of hospitals recruited to participate in AEGIS
- Number of hospitals completing training, message extract and reporting syndromic surveillance data
- Development of a proof of concept to submit clinical data from ambulatory care clinics and community health centers
- Number of ambulatory care clinics and community health centers reporting clinical data for notifiable diseases

Measures of Effectiveness:

- By the end of the cooperative agreement all hospitals will have been recruited to participate in AEGIS
- Within 12 months of the award date, detailed protocols will be developed to specify how EHR data will be submitted to the BID utilizing the existing ELR infrastructure
- Within 18 months of the award date, at least one regional HIE and the community health center HIE will be reporting clinical data for notifiable diseases to MDPH

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Activity 3:

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- Participation in activities to develop use cases for public health laboratories to exchange data with EHRs and public health agencies

Measures of Effectiveness:

- As requested by CDC, MDPH staff participates in all appropriate activities
- Business and use cases to support data exchange with other award recipients

Activity 4:

- Continue to use current person and event deduplication algorithms within MAVEN to ensure appropriate data management
- Maintain unique sample and reporting identification of test information with clinical partners to prevent data duplication in expanded HL7 electronic ordering and reporting

Measures of Effectiveness:

- Persons and disease events are successfully deduplicated within MAVEN
- Unique test sample and reporting identification information maintained with clinical partners to prevent data duplication in expanded HL7 electronic ordering and reporting

Activity 5:

- Continue BLS participation in development of PHLIP messaging for reportable diseases.
- Implement influenza message structure according to the PHLIP Influenza Messaging and Encoding Guidelines.

Measures of Effectiveness:

- BLS participates in all PHLIP Messaging activities for all reportable diseases
- PHLIP messaging for Influenza moved to PHINMS production

Activity 6:

- MDPH gathers information on services and solutions provided by LTIAPH grantee and LTISSA to ensure the MDPH critical IT infrastructure to supports interoperability of electronic laboratory data between clinical care (through EHRs) and public health agencies. Request initial evaluation and recommended approach from LTIAPH grantee

Measures of Effectiveness:

- MDPH critical IT infrastructure to supports interoperability of electronic laboratory data between clinical care (through EHRs) and public health agencies

Activity 7:

- IT infrastructure is assessed against NHIN, PHIN, ELR, HITSP and PHLIP standards.
- Successful certification of PHIN Varicella Case Notification Message and Generic Case
- Develop test and production plans and tools data exchange with other grant recipients

Measures of Effectiveness:

- Within 12 months of the award date MDPH has been certified for PHIN Varicella Case Notification Message and for PHIN Generic Case Notification Message
- IT infrastructure is aligned with NHIN, PHIN, ELR, HITSP and PHLIP standards.
- Test and production plans for data exchange and tools developed and shared with the CDC and other grant recipients

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Activity 8:

- MDPH will request assistance of the PHLIP technical assistance teams through APHL to assist in implementing the PHLIP ELSM and connection to CDC through the RnR hubs.

Measures of Effectiveness:

- MDPH will implement the PHLIP ELSM and connection to CDC through the Route not Read hubs. (Flu SPHL to CDC flu division)

Activity 9:

- Participate in all appropriate CDC conference calls to support and promote the goals and objectives of the cooperative agreement

Measures of Effectiveness:

- During the course of the cooperative agreement, all conference calls regarding this project are appropriately attended by MDPH staff

Activity 10:

- Participate in user groups to share successes and lessons learned with other awardees to promote the exchange of information with EHRs

Measures of Effectiveness:

- During the course of this cooperative agreement, MDPH staff will participate in all user groups regarding this project

Activity 11:

- Development of a sustainability plan for post cooperative agreement operations

Measures of Effectiveness:

- Within 18 months of the award date, MDPH will develop a sustainability plan to ensure each project's on going success once the cooperative agreement has ended

Activity 12:

- Detailed and up-to-date project plans

Measures of Effectiveness:

- Within 1 month of the award date, MDPH will have updated or created new project plans for each funded activity.

Activity 13:

- Development of a system metrics to assess project performance.

Measures of Effectiveness:

- From the onset of the cooperative agreement, MDPH staff will work in collaboration with other awardees to develop clear metrics to assess the project performance.

Activity 14

- Programmatic and fiscal activity reports requirements are developed

Measures of Effectiveness:

- In accordance with the requirements of this cooperative agreement, ARRA and OMB, MDPH will submit all necessary reports to CDC in the timeline required. This includes:
 - Monthly and quarterly progress reports and participation in semi-annual evaluations

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- Submission of a final report within 90 days of the end of the project 24 month period.